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(54) Abstract Title
Physical shared channel allocation in a wireless communication system

(57) A system and method for physical shared channel allocation in a UMTS wireless communication system. A physical shared channel allocation message is sent containing a plurality of occurrences of allocated physical resources and TFCS IDs; and, at a radio unit 130A, the sent physical shared channel allocation message is received and the plurality of occurrences of allocated physical resources and TFCS IDs contained therein are processed, thereby allowing a plurality of CCTrCHs to be allocated with a single physical shared channel allocation message.

This provides the advantage that, using only a limited set of defined transport format combinations, a large portion of the physical resource can be allocated and used by a single UE using a single physical shared channel allocation message.

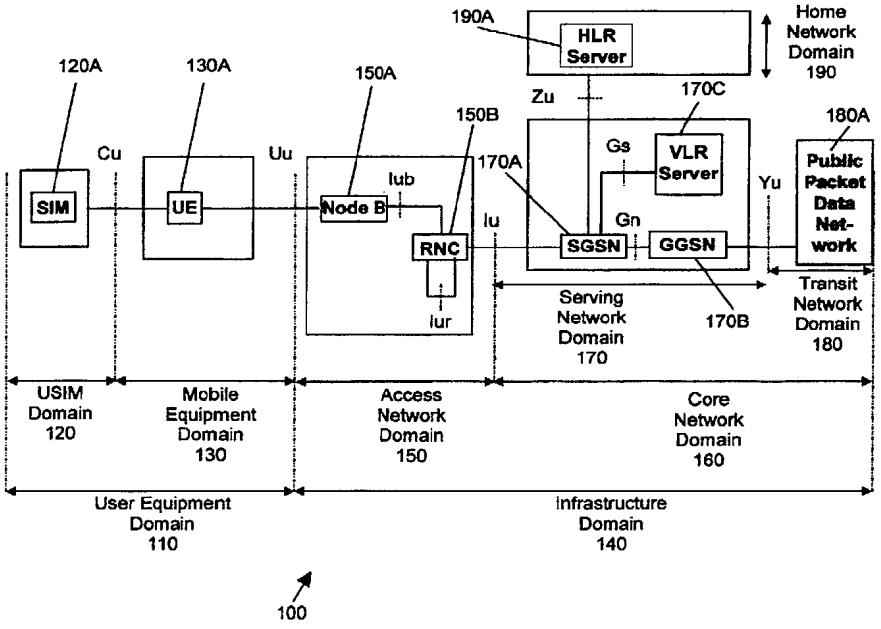

FIG. 1

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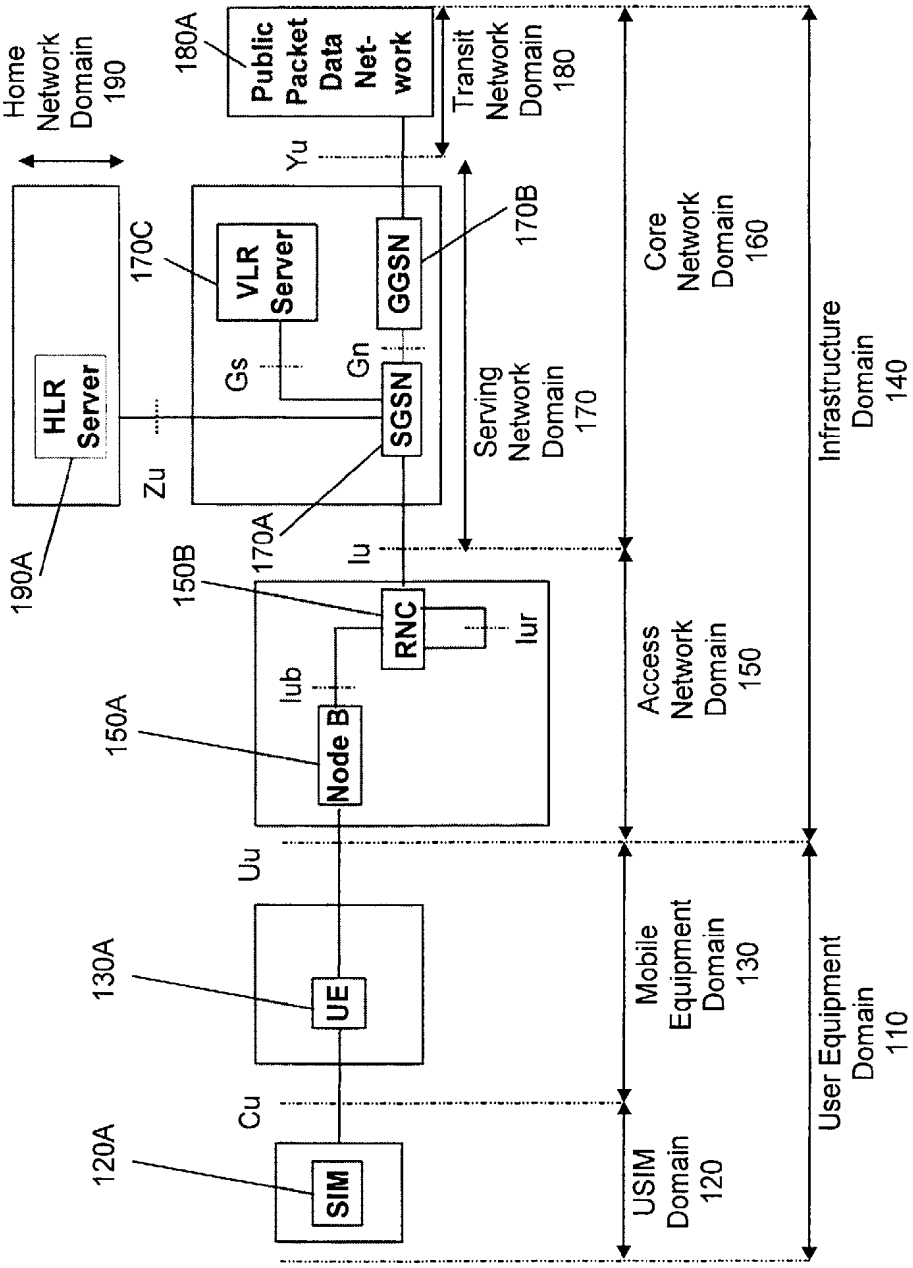
Home Network Domain 190
180A
Public Packet Data Network
Transit Network Domain 180
Yu
170C
VLR Server
GGSN
170B
HLR Server
Gs
Gn
SGSN
Serving Network Domain 170
Core Network Domain 160
Infrastructure Domain 140
Zu
190A
170A
Iu
150B
RNC
Iur
Iub
150A
Node B
Access Network Domain 150
Uu
130A
UE
Mobile Equipment Domain 130
Cu
120A
SIM
USIM Domain 120
User Equipment Domain 110
100

FIG. 1

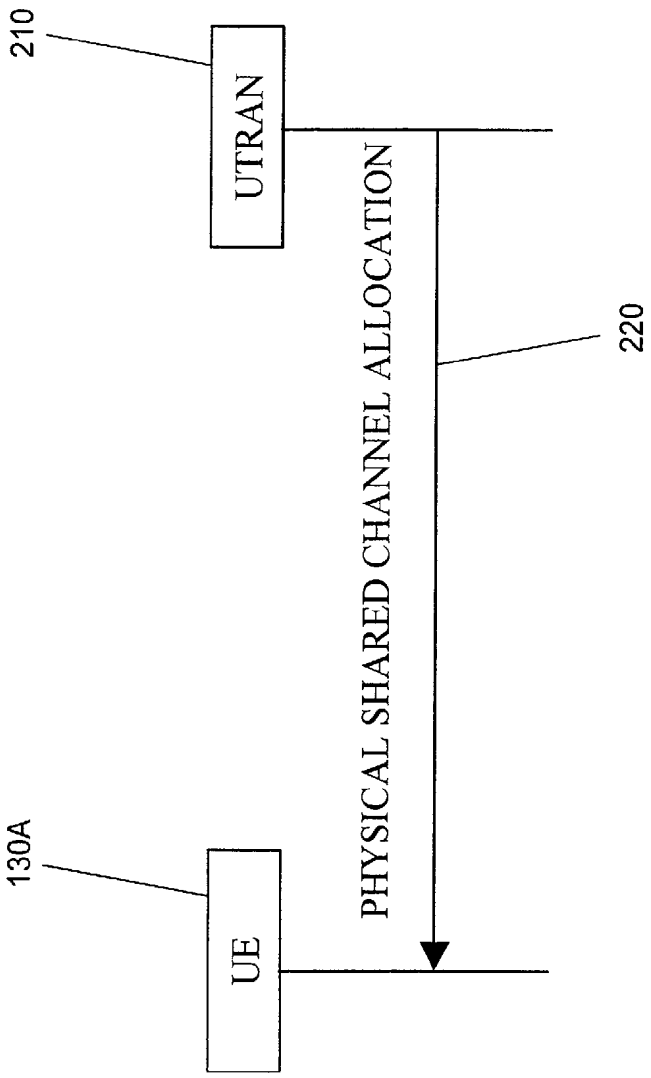

FIG. 2

SYSTEM AND METHOD FOR PHYSICAL SHARED CHANNEL ALLOCATION IN A WIRELESS COMMUNICATION SYSTEM

Field of the Invention

This invention relates generally to wireless communication systems, and particularly (though not exclusively) to wireless communication systems complying with the 3GPP (3rd Generation Partnership Project) standard when shared channels are employed.

Background of the Invention

In the field of this invention it is known that in a 3GPP system the PHYSICAL SHARED CHANNEL ALLOCATION message is used to allocate shared channel physical resources to different units of user equipment (UE) in both uplink and downlink.

A single set of physical resources are defined along with a transport format combination set ID (TFCS ID). The TFCS ID defines a number of transport format combinations (TFC) which are allowed on a coded composite transport channel.

In this way a single coded composite transport channel (CCTrCh) can be allocated using the PHYSICAL SHARED CHANNEL ALLOCATION message.

The PHYSICAL SHARED CHANNEL ALLOCATION message can define separately physical resources and TFCS IDs for both uplink and downlink.

However, this approach has the disadvantage that only a single coded composite transport channel can be allocated (in uplink and downlink) by a single PHYSICAL SHARED CHANNEL ALLOCATION message. This can give rise to either:

1. a large number of PHYSICAL SHARED CHANNEL ALLOCATION messages and consequently significant latency when a large portion of the physical resources is allocated to different users from frame to frame, which is likely to be the case when large proportions of the entire physical resource is set aside to shared channels and packet data applications are used.
2. Very large numbers of transport format combinations having to be signalled which encompass multiple timeslots.

A need therefore exists for a mechanism to permit multiple cctrch allocations from a single physical shared channel allocation message wherein the abovementioned disadvantages may be alleviated.

Statement of Invention

In accordance with a first aspect of the present invention there is provided a wireless communication system as claimed in claim 1.

In accordance with a second aspect of the present invention there is provided a method for physical shared channel allocation in a wireless communication system as claimed in claim 4.

In accordance with a third aspect of the present invention there is provided a radio unit for use in a wireless communication system as claimed in claim 7.

In accordance with a fourth aspect of the present invention there is provided a radio unit for use in a wireless communication system as claimed in claim 8.

Brief Description of the Drawings

One system and method for permitting multiple CCTrCh allocations from a single physical shared channel allocation message in accordance with the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 shows a block diagrammatic representation of a 3GPP system in which the present invention is used; and

FIG. 2 shows a block schematic diagram illustrating Physical Shared Channel Allocation in the system of FIG. 1.

Description of Preferred Embodiment

Referring firstly to FIG. 1, a typical, standard UMTS network (100) is conveniently considered as comprising: a user equipment domain (110), made up of a user SIM (USIM) domain (120) and a mobile equipment domain (130); and an infrastructure domain (140), made up of an access network domain (150), and a core network domain (160), which is in turn made up of a serving network domain (170) and a transit network domain (180) and a home network domain (190).

In the mobile equipment domain (130), user equipment UE (130A) receives data from a user SIM (120A) in the USIM domain 120 via the wired Cu interface. The UE (130A) communicates data with a Node B (150A) in the network access domain (150) via the wireless Uu interface. Within the network access domain(150), the Node B (150A) communicates with an RNC (150B) via the Iub interface. The RNC (150B) commmunicates with other RNC's (not shown) via the Iur interface. The RNC (150B) communicates with a SGSN (170A) in the serving network domain (170) via the Iu interface. Within the serving network domain (170), the SGSN (170A) communicates with a GGSN (170B) via the Gn interface, and the SGSN (170A) communicates with a VLR server (170C) via the Gs interface. The SGSN (170A) communicates with an HLR server (190A) in the home network domain (190) via the Zu interface. The GGSN (170B) communicates with public data network (180A) in the transit network domain (180) via the Yu interface.

Thus, the elements RNC (150B), SGSN (170A) and GGSN (170B) are conventionally provided as discrete and separate units (on their own respective software/hardware platforms) divided across the access network domain (150) and the serving network domain (170), as shown the FIG. 1.

The RNC (150B) is the UTRAN (UMTS Terrestrial Radio Access Network) element responsible for the control and allocation of resources for numerous Node B's (150A); typically 50 to 100 Node B's may be controlled by one RNC. The RNC also provides reliable delivery of user traffic over the air interfaces. RNC's communicate with each other (via the interface Iur) to support handover and macrodiversity.

The SGSN (170A) is the UMTS Core Network element responsible for Session Control and interface to the Location Registers (HLR and VLR). The SGSN is a large centralised controller for many RNCs.

The GGSN (170B) is the UMTS Core Network element responsible for concentrating and tunnelling user data within the core packet network to the ultimate destination (e.g., internet service provider - ISP).

In essence, in a preferred embodiment of the present invention, the PHYSICAL SHARED CHANNEL ALLOCATION message is modified to be able to allocate multiple CCTrCh's. In this way shared channel allocations mirror the way in which DPCHs are allocated in the IE 'downlink DPCH info

for each RL' in that multiple CCTrChs can be allocated in a single message.

The PHYSICAL SHARED CHANNEL ALLOCATION message contains a list of physical resources together with transport format combination set IDs for each defined set of physical resources. The length of the list is defined by the known variable 'maxCCTrCh'. Two separate lists of TFCS ID and physical resources are required for uplink and downlink respectively.

When the UE receives the PHYSICAL SHARED CHANNEL ALLOCATION message it goes round this list and defines multiple CCTrChs (upto maxCCTrCh CCTrCh's can be defined).

Referring now also to FIG. 2, the purpose of the procedure shown in the FIG. 2 is to allocate radio resources to USCH (Uplink Shared CHannel) and/or DSCH (Downlink Shared CHannel) transport channels in TDD (Time Division Duplex) mode, for use by a UE. This procedure can also be used to indicate to the UE, that a PUSCH (Physical USCH) allocation is pending, in order to prevent further capacity requests from the UE.

To initiate the Physical Shared Channel Allocation procedure, the UTRAN (210) sends the "PHYSICAL SHARED CHANNEL ALLOCATION" message (220), which contains the list, to the UE (130A).

Upon reception of a "PHYSICAL SHARED CHANNEL ALLOCATION" message, the addressed UE will

configure the physical resources used for each downlink CCTrCH given by the IE Information Element) "TFCS ID" in the list according to the following:

- if the CHOICE "Configuration" has the value "Old configuration":
  - if the UE has stored a PDSCH (Physical DSCH) configuration with the identity given by the IE "PDSCH Identity":
    - configure the physical resources according to that configuration;
  - otherwise:
    - ignore the IE "PDSCH capacity allocation info list";
- if the CHOICE "Configuration" has the value "New configuration":
  - configure the physical resources according to the information given in IE "PDSCH Info". If IE "Common timeslot info" or IE "PDSCH timeslots and codes" IE are not present in IE "PDSCH Info":
    - reuse the configuration specified in the previous "PHYSICAL SHARED CHANNEL ALLOCATION" message for this CCTrCH;
  - if the IE "PDSCH Identity" is included:
    - store the new configuration using that identity;
- start using the new configuration at the CFN specified by the IE "Allocation activation time",

and use that for the duration given by the IE "Allocation duration";

- if the IE "Confirm request" has the value "Confirm PDSCH" and IE "PDSCH Identity" is included in IE "PDSCH capacity allocation info list":
  - initiate the known PUSCH CAPACITY REQUEST procedure
- if the IE "PUSCH capacity allocation info list" is included:
- stop the known timer T310, if running;
- if the CHOICE "PUSCH allocation" has the value "PUSCH allocation pending":
  - start the known timer T311;
- if the CHOICE "PUSCH allocation" has the value "PUSCH allocation assignment":
  - stop the known timer T311, if running;
  - configure the physical resources used for each uplink CCTrCH given by the IE "TFCS ID" in the list according to the following:
    - if the CHOICE "Configuration" has the value "Old configuration":
      - if the UE has stored a PUSCH configuration with the identity given by the IE "PUSCH Identity":
        - configure the physical resources according to that configuration;
      - otherwise:
        - ignore the IE "PUSCH capacity allocation info list";
    - if the CHOICE "Configuration" has the value "New configuration", the UE will:

- configure the physical resources according to the information given in IE "PUSCH Info". If IE "Common timeslot info" or IE "PUSCH timeslots and codes" is not present in IE "PUSCH Info":
  - reuse the configuration specified in the previous "PHYSICAL SHARED CHANNEL ALLOCATION" message for this CCTrCH.
- if the IE "PUSCH Identity" is included:
  - store the new configuration using that identity;
- start using the new configuration at the CFN specified by the IE "Allocation activation time", and use that for the duration given by the IE "Allocation duration";
- if the IE "Traffic volume report request" is included:
  - initiate the known PUSCH CAPACITY REQUEST procedure at the time indicated by the IE "Traffic volume report request";
- if the IE "Confirm request" has the value "Confirm PUSCH" and IE "PUSCH Identity" is included in IE "PUSCH capacity allocation info list":
  - initiate the known PUSCH CAPACITY REQUEST procedure.
- determine the TFCS subset and hence the TFCI values which are possible given the PUSCH allocation for that CCTrCH;
- configure the MAC (Medium Access Control) in the UE with this TFCS restriction if necessary;

- transmit USCH Transport Block Sets as required, within the TFCS limits given by the PUSCH allocation.

Finally, the UE will:

- clear the entry for the PHYSICAL SHARED CHANNEL ALLOCATION message in the table "Accepted transactions" in the variable TRANSACTIONS;
- and the procedure ends.

It will be appreciated that the mechanism described above will typically be implemented by adapting or reprogramming one or more processors in the UE or Node B. As such the required adaptation may be implemented in the form of processor-implementable instructions stored on a storage medium, such as a fixed or removable magnetic or optical disk, PROM, RAM or any combination of these or other storage media.

It will be understood that the mechanism for permitting multiple CCTrCh allocations from a single physical shared channel allocation message described above provides the advantage that, using only a limited set of defined transport format combinations, a large portion of the physical resource can be allocated and used by a single UE using a single PHYSICAL SHARED CHANNEL ALLOCATION message.

Claims

1. A wireless communication system employing a physical shared channel allocation message to allocate a radio unit to a shared physical channel, the system comprising:

means for sending a physical shared channel allocation message containing a plurality of occurrences of allocated physical resources and transport identifications; and

means at the radio unit for receiving the sent physical shared channel allocation message and processing the plurality of occurrences of allocated physical resources and transport identifications contained therein, thereby allowing a plurality of composite transport channels to be allocated with a single physical shared channel allocation message.

2. The wireless communication system as claimed in claim 1 wherein the number of composite transport channels allocated by the physical shared channel allocation message is equal to the maximum allowed number of composite transport channels allowed in the system.

3. The wireless communication system as claimed in claim 1 or 2 wherein the system is a UMTS system, the transport identifications are transport format combination set composite set identifications, and the transport channels are coded composite transport channels.

4. A method for physical shared channel allocation in a wireless communication system to allocate a radio unit to a shared physical channel, the method comprising:

sending a physical shared channel allocation message containing a plurality of occurrences of allocated physical resources and transport identifications; and

receiving, at the radio unit, the sent physical shared channel allocation message and processing the plurality of occurrences of allocated physical resources and transport identifications contained therein, thereby allowing a plurality of composite transport channels to be allocated with a single physical shared channel allocation message.

5. The method for physical shared channel allocation as claimed in claim 4 wherein the number of composite transport channels allocated by the physical shared channel allocation message is equal to the maximum allowed number of composite transport channels allowed in the system.

6. The method for physical shared channel allocation as claimed in claim 4 or 5 wherein the system is a UMTS system, the transport identifications are transport format combination set composite set identifications, and the transport channels are coded composite transport channels.

7. A radio unit for use in a wireless communication system employing a physical shared channel allocation messaging for allocation to a shared physical channel, the radio unit comprising:

means for sending a physical shared channel allocation message containing a plurality of occurrences of allocated physical resources and transport identifications; and

whereby a radio unit receiving the sent physical shared channel allocation message and processing the plurality of occurrences of allocated physical resources and transport identifications contained therein can be allocated to a plurality of composite transport channels with a single physical shared channel allocation message.

8. A radio unit for use in a wireless communication system employing a physical shared channel allocation messaging for allocation to a shared physical channel, the radio unit comprising:

means for receiving a physical shared channel allocation message containing a plurality of occurrences of allocated physical resources and transport identifications, and for processing the plurality of occurrences of allocated physical resources and transport identifications contained in the received message, whereby a plurality of composite transport channels can be allocated with a single physical shared channel allocation message.

9. The radio unit as claimed in claim 7 or 8, wherein the number of composite transport channels allocated by

the physical shared channel allocation message is equal to the maximum allowed number of composite transport channels allowed in the system.

10. The radio unit as claimed in claim 7, 8 or 9 wherein the system is a UMTS system, the transport identifications are transport format combination set composite set identifications, and the transport channels are coded composite transport channels.

11. A storage medium storing processor-implementable instructions for controlling a processor to carry out the method of claim 4, 5 or 6.

12. A wireless communication system substantially as hereinbefore described with reference to the accompanying drawings.

13. A method of physical shared channel allocation in a wireless communication system substantially as hereinbefore described with reference to the accompanying drawings.

14. A radio unit for use in a wireless communication system substantially as hereinbefore described with reference to the accompanying drawings.

Application No: GB 0116557.0 | 5 **Examiner:** Glyn Hughes
Claims searched: 1 to 14 **Date of search:** 19 February 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4L (LDLS, LRRMW)

Int Cl (Ed.7): H04Q 7/38, H04L 29/06

Other: Online: WPI, JAPIO, EPODOC, INSPEC, INTERNET

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	EP 1009174 A2	(LG) see whole document	-
A	EP 1001642 A1	(MITSUBISHI) see whole document	-
A	WO 01/17283 A2	(ERICSSON) see whole document	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.